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ABSTRACT

The thesis of this paper is that the growth of the field of medical informatics, while seemingly a potential threat to medical librarianship, is in fact an opportunity for librarianship to both extend its reach and also to further define its unique characteristics in contrast to those of medical informatics. Furthermore, because medical librarianship represents a sector of librarianship itself, the relationship between medical informatics and medical librarianship provides an example of the influence of a cognate field on the profession of librarianship that may extend across the profession. This paper defines both medical informatics and librarianship, their areas of overlap and their claims to professionalism. The "informationist" a new health professional, which was recently proposed in one of the leading U.S. medical journals, illustrates one model of collaboration between the two fields. The paper concludes by suggesting new educational pathways. (Contains 24 references.) (Author)

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The Impact of Medical Informatics on Librarianship

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Introduction

Throughout the world libraries and librarians are in the midst of a great transformation driven by technology but with consequences that reach far beyond it. The theme of this year's seventy-fifth anniversary IFLA conference reflects librarianship's fundamental values--democracy, diversity and delivery of information to society. One of the unexpected consequences of the digital revolution is that both the means and the desire to control information delivery is no longer the exclusive domain of libraries and librarians. As "information" has become an attractive and highly prized commodity, new disciplines have emerged and new occupational groups now perform work once thought the exclusive domain of librarians. While their work seems similar, these new information workers may not share the same values. If librarians are to retain their place in society, and continue to advocate for these core values, they must examine and understand the cognate disciplines whose knowledge and functions resemble—and even challenge--their own. By more clearly articulating the role and value of libraries and librarians, librarianship can embrace new opportunities and adapt to the continued challenges of technological, economic and political change.

One arena in which these challenges and changes are fully engaged is medicine and health. Health care delivery is a national and global priority and one in which both information and technology are essential. Although health care delivery systems vary widely among nations, the need for timely, accurate information is universal. Where resources are scarce, self-care and public health are increasingly important since information must be made available to the individual patient and citizen, not just the health worker. To accomplish this goal—creating and maintaining an efficient information network

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capable of serving clinicians, researcher, patients and the public-- a highly skilled workforce is necessary. To accomplish this goal while retaining librarianship's core values requires expanded attention to education.

The thesis of this paper is that the growth of the field of medical informatics, while seemingly a potential threat to medical librarianship, is in fact an opportunity for librarianship to both extend its reach and also to further define its unique characteristics in contrast to those of medical informatics. Furthermore, because medical librarianship represents a sector of librarianship itself, the relationship between medical informatics and medical librarianship provides an example of the influence of a cognate field on the profession of librarianship that may extend across the profession. This paper will define both medical informatics and librarianship, their areas of overlap and their claims to professionalism. The "informationist" a new health professional which was recently proposed in one of the leading U.S. medical journals—will illustrate one model of collaboration between the two fields. The paper will conclude by suggesting new educational pathways.

Definitions and history

Librarianship (library and information studies)

Throughout the world, libraries and librarians perform functions on behalf of society. These functions are to acquire, preserve, organize, analyze, and provide subsidized access to the accumulated data, information and knowledge generated by its citizens. While all library professionals perform these functions, this paper focuses on a specific sector—health sciences. Because librarians are familiar with the historical development of the profession as well as its knowledge, skills, values and practices, only a brief definition of the field is necessary. This is taken define the field of library and information studies as concerned with

> ...recordable information and knowledge, and the services and technologies to facilitate their management and use, encompassing information and knowledge creation, communication, identification, selection, acquisition, organization and description, storage and retrieval, preservation, analysis, interpretation, evaluation, synthesis, dissemination and management. (American Library Association, 1992).

Librarians perform these services on behalf of society, either individually or in the aggregate, and they perform them regardless of their particular physical location or venue. While it is possible to practice librarianship outside of a library using "virtual information," the function that libraries perform on behalf of society primarily involves physical artifacts or their digital representations that have been created to be disseminated to other individuals or groups.

Medical informatics

Medical informatics as a discipline has strong European origins. Indeed the term "informatics" appears in French as "informatique" and was relatively unknown in English until recently. The appearance of medical informatics is associated by some with the 1959 publication in *Science* of an article by Ledly and Lusted on reasoning foundations of medical diagnosis (Giuse & Miller, 1995). This focus on medical diagnosis and decision-making continued and evolved, along with computer, information and library science. Many may recall that during the last quarter of the twentieth century, a common metaphor for the computer was the human brain. Conversely, the brain as computer figured prominently in the literature of cognitive science—the science of knowing. An early application of cognitive science to medicine was computer aided diagnosis using expert systems such as INTERNIST—although such experimental

systems have not turned out to be as useful as initially hoped. Similarly, expert systems technology was also a research front in LIS for a time, but in neither field was it ultimately fruitful.

Medical informatics initially consisted of computer and information technology focused on medical problems. By the 1980s, however, a more integrated view of medical computing emerged, prompting Marsden Blois to write enthusiastically about the role of the computer in medicine. He saw computing as a "novel research tool" whose possibilities "can hardly be exaggerated." Blois envisioned computers that would help not only to manage information, but also understand its nature a support decision-making in clinic and laboratory (Blois, 1986). He also foresaw the developments of the past decade in which the digital revolution and managed care have made information management a major activity of the health care professional.

By 1990, Greenes and Shortliffe were calling for medical informatics to be an institutional priority. In their article in JAMA, they define medical informatics as

> .... the field that concerns itself with the cognitive, information processing, and communication tasks of medical practice, education, and research, including the information science and the technology to support these tasks. An intrinsically interdisciplinary field, medical informatics has a highly applied focus, but also addresses a number of fundamental research problems as well as planning and policy issues... (Greenes & Shortliffe, 1990).

This definition accurately reflects the literature, the practice and the function of medical informatics. It acknowledges that the computer can extend, but not replace, the human ability to manage and analyze information. Rather than thinking of the brain as a computer, medical informatics today recognizes the distinction between the computer's ability and human ability.

Knowledge and skills

Once a field of study has been defined, what are the knowledge and skills required to work in this field? In a profession, knowledge and skills build upon scientific, historical and scholarly principles that are harnessed for a social or public good. In comparing librarianship's skills with those required for medical informatics specialists (recognizing that for each field today, the acquisition of basic information technology skills is a given), librarianship concerns itself with process and structure across generic subject areas, whereas medical informatics focuses on specific domain knowledge.

Librarianship skills consist of generic knowledge necessary for individuals and groups to participate in the acquisition, exchange, and organization of knowledge. These skills enable librarians to anticipate future information needs so that appropriate information resources can be acquired and preserved for future use. Medical informatics skills consist of applied and theoretical knowledge necessary to adapt generic information science to the biomedical domain. These skills enable medical informaticists to focus on specific teaching, research and health care agenda; they must be able to draw upon a deep understanding of biomedical information systems (Frisse, 1994).

This tension—between the need for knowledge of information as information and the need for specific domain knowledge—has long been debated among library educators and administrators. Marcia Bates in her paper "The Invisible Substrate of Information Science" argues that the primary characteristic of library and information science is the ability to think about a information resource in terms of the features that matter to its organization and retrieval, rather than mastering its content. In order to work in information– or perhaps in informatics—it is necessary to be come an expert in information use and management. A subjection specialist WITHOUT information education and training simply cannot work in the information field (Bates, 1999). According to this argument, the field of medical informatics must

combine full information education with subject specialization. The competent medical informaticist must be cross-trained in biomedicine—"domain knowledge"-- as well as in information science. Presumably, the train runs in both directions and the health librarian must be cross-trained in biomedicine as well as in information science. If such is the case, is there a difference between these two pathways, and if so, which of these pathways is the more desirable? While it can certainly be argued that training in medical informatics is a viable pathway, the issue of professional values and professional jurisdiction must be answered.

The effect of being a profession

While those attending IFLA most likely have little doubt that librarianship is a profession, the elements that constitute professionalism may not be clear. Continued study while applying knowledge and skills to perform a public service characterize a profession. Librarians have long embraced public service as a cornerstone of the profession. Medical informatics, however, is in the process of determining whether there is a profession of medical informatics or whether medical informatics is a discipline of its own or a sub-discipline of another field, most likely, medicine. As the protracted investigations of Bill Gates and Microsoft illustrate, many disciplines within computer science are neither public nor oriented toward service. Some have argued, however, that medical informatics does indeed constitute a profession because it looks at the user's needs in all their complexity (Giuse and Miller, 1995) –and such an argument, to the extent that it is valid, certainly brings medical informatics much closer to librarianship.

Andrew Abbott in his book *The System of Professions* argues that the chief characteristic of professional work is education in an abstract, academic knowledge base that provides the context in which to learn procedures. Academic knowledge is abstract, not process-oriented, while practical/professional knowledge focuses on procedures. Academic knowledge legitimizes a profession's claims that its expert work effectively addresses the problems it has defined. Expert work is done in the context of expert knowledge, and it is expertise that enables a profession to lay claim to the control of specific functions in a society(Abbott, 1988). Another way to say this is that one must study X (expert knowledge) in order to become qualified to do Y (expert professional work). Within this framework, medical librarianship's claim to its traditional domain could be threatened by medical informatics' emergence and continued progress toward professionalism.

As medical informatics has moved beyond focusing solely on technology to embrace a deep understanding of biomedical information systems, the distinctions between medical librarianship and medical informatics have blurred. This has even been described as a disruption in the balance among the health professions. The expert knowledge and practice of health information librarians has always the management of print-based, published literature using bibliographic systems. For most of the twentieth century, medical librarians focused on meeting the information needs of the health professional, not the patient or consumer. The expert knowledge and practice of medical informaticists has been primarily medicine, rather than information. Furthermore, recent trends in medical informatics have extended beyond knowledge-based information (the literature) to patient data as exemplified in the electronic health record. Their interest in both these areas is limited to the extent that it supports good clinical practice. However, both systems have been affected by external trends, placing them on a collision course with one another. The medical librarian now deals with electronic literature, as well as a multiplicity of digital "information" which is not published in the traditional sense. Medical libraries—and the electronic systems that extend their reach—now focus on patients and consumers, in addition to health professionals. While medical informatics has become more user focused, its legitimate claim to authority in health care faces challenges from the external environment (Bradley, 1996).

Evidence-Based Medicine (EBM) and Medical Information

As part of a 1999 American Medical Informatics Association (AMIA) conference, participants described the current environment for health care, particularly as it affects information. They identified these trends:

- Integrated health delivery systems need standards for data sharing
- Converging technologies mean larger and faster databases but with smaller faster and cheaper hardware.
- Empowered patients and consumers have more access to information
- Higher education requires technology-assisted learning, distance education and lifelong learning (Staggers, et al., 2000)

The impact of evidence-based medicine (EBM) on public health and the empowerment of consumers and patients is increasingly apparent. Evidence-based medicine requires critical appraisal of the medical literature and the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. The practice of evidence-based medicine means integrating individual clinical expertise with the best available clinical evidence from systematic research (Sackett, 1996). It de-emphasizes intuition and anecdotal experience and stresses the examination of evidence from clinical research along with applying formal rules of evidence for systematically evaluating the clinical literature. A group of physicians in Great Britain is credited with the initiation of this approach and the results of the their systematic reviews of the medical literature are compiled in the Cochrane Collection. The movement has spread rapidly to North America and is now being discussed in the popular press. A recent article in the New York Times Magazine stated that "patients, working with their physicians and armed with medical data, are better equipped to make decisions that work for them than [traditional doctors] because they understand their own expectations better than their physicians can. Authority is devolved from expertise to the data and thus, ultimately, to the patient(Patterson, May 5, 2002). This shift in authority, with the simultaneous increase in consumer access to health information places information clearly at the center of health care. Add to that the growing need for agreement on an acceptable electronic health record, and the importance of information to health care has never been more critical

Clearly, the practice of EBM involves literature search and appraisal skills that are part of the core knowledge of librarians. What librarians have thus far lacked is the domain knowledge that comes naturally to the medical informaticist. The medical informatics practitioner seeks to bring computational power to this process, not only in the search, retrieval and appraisal of the literature, but also the communication of the results of the appraisal to the bedside or office. The medical informatics specialist may or may not have the commitment to public health that librarians have. Furthermore, the medical informatics specialist likely performs this task to meet his or her (teams') specific interest. The librarian is expected to be able to perform these tasks on behalf of others.

The social impact of information, combined with the delicate policy and ethical issues surrounding patient confidentiality and security of health records, make it essential that those who are working in the health information field have the information skills, the domain knowledge and the ethics and values that characterize a profession. In fact, ethics and policy decisions have come to replace technological expertise as the most important characteristics both of medical informatics and librarianship. While technology--particularly web technology—has made it possible to seamlessly integrate clinical data and knowledge-based information to support informed decisions, there are policy and organizational decisions that must be made. Recently Betsy Humphreys, Associate Director of the National Library of Medicine stated,

> When this goal [of data and knowledge supported decision-making] first gained currency, the assumption was that health care professionals were the decision makers. Clinicians remain a

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> primary target for integrated "just-in-time" information services, but these services are also needed by public health professionals and, in an era in which individuals are assuming more responsibly for their health, by patients and the well public (Humphreys, 2000).

While great progress has been made in the technical and organizational requirements, conceptual decisions, such as designing and implementing standards for the sharing and transfer of data, as well as the public policy decisions are enormous barriers that must be cover come.

A New Model: The Informationist

In order for these barriers to be overcome the joining of medical informatics and librarianship is a necessity. A recent article appearing in the U.S. journal *Annals of Internal Medicine* has proposed a new information professional, the informationist (Davidoff & Florance, 2000). Such an individual would bridge the gap between clinicians and patients and would be most closely modeled after clinical librarians, a practice developed in the 1970s. Informationist must understand both information science and clinical work. They must be experts in the practice of retrieving, synthesizing, and presenting medical information and in the skills of functioning as part of a clinical care team—skills that are usually acquired through an internship. These are skills which could evolve from the core knowledge of librarianship. In addition, the informationist model draws from medical informatics in that it requires the cultural adaptation of internship through which to gain the "deep understanding" of biomedical information systems. Furthermore, the model of the informationist draws upon medical informatics in its commitment to the development of a research agenda and to the design, evaluation and improvement of information systems. These tasks are not unknown to librarians, but generally speaking librarianship has seen itself primarily as a service profession, one whose research base is quite small and whose technical expertise relatively constrained.

Educational pathways

Educating professionals so that they are capable of assuming the role of informationist is essential if the informationist model is to survive beyond the proposal and discussion stage. The education of both groups—clinicians and librarians—has been the focus of several conferences over the past few years. Throughout the decade of the nineties, educating health professionals, including librarians, has been the focus of a number of review panels and conference in Great Britain (Palmer, 2000). These were paralleled in the U.S. In the early 1990s as part of its Long Range Plan, the National Library of Medicine convened a planning panel on the education and training of health sciences librarians. In 1999, the American Medical Informatics Association devoted its spring conference to informatics education (Staggers, 1999). And in April 2002, the Medical Library Association, with funding from the National Library of Medicine (NLM), held a two-day conference on the informationist, during which educational strategies were discussed.

Currently, there is no single pathway for preparing informationist. In a recent article, Harsh, a medical informatics professionals, stated "Library science and medical informatics have developed as intersecting fields with similar interests but significant divergences in scope and activity.... We now have an opportunity for the two field to work together" (Hersh, 2002). Detlefsen, a library educator specializing in health sciences librarianship, identified the various pathways for such collaboration to occur. The traditional preparation in North America for entry into librarianship is the master's degree accredited by the American Library Association. This is a usually a generalist degree, with limited opportunities for specialization in health sciences librarianship, except where this can be accomplished through collaboration with a local medical center. A second pathway is training programs in universities either with or without schools of library and information science; these universities can apply for training grants from outside agencies, usually the National Library of Medicine. Short, intensive courses such as those

sponsored by the NLM at Woods Hole Marine Biological Lab, can be taken by both librarians and clinicians. Similarly, continuing education course sponsored by professional associations can provided intensive training to both groups. The benefit of the NLM programs however, is the exchange that takes place among participants of differing educational and professional backgrounds. An emerging model is distance education, in which educational providers make courses available through distance technology. Hersh describes one such program in a recent report (Hersh, et al., 2001)

The influence of medical informatics on librarianship, then, is the melding of these two fields into the informationist model. There is one additional issue--which is the ethics and values of a profession or practice. Medical informatics specialists perceive themselves as primarily trained in medicine—medical professionals with an overlay of information skills that are enhanced by technological fluency. Librarians concern themselves with knowledge about information *qua* information, its representation, structure and behavior. The librarian does not generally acquire domain knowledge as part of professional preparation. The informationist model provides a new opportunity for librarians and medical informatics to join together. Neither has an unequivocal claim to this territory and both possess unique contributions to make. The medical informatics specialist has the domain knowledge; the librarian excels in the information skills. The librarian has a long history of advocating for information democracy, for empowering the individual through access to information, and for ensuring the high quality information is delivered to the user, whether that user is patient, consumer or health professional. The medical informationist challenges librarians to further articulate these skills and to acquire the domain knowledge and cultural facility so as not to lose claim to this professional territory.

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